National Institute of Environmental Health Sciences

Increase in summer European ozone amounts due to climate change

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Abstract:

The local and regional distribution of pollutants is significantly influenced by weather patterns and variability along with the spatial patterns of emissions. Therefore, climatic changes which affect local meteorological conditions can alter air quality. We use the regional air quality model CHIMERE driven by meteorological fields from regional climate change simulations to investigate changes in summer ozone mixing ratios over Europe under increased greenhouse gas (GHG) forcing. Using three 30-year simulation periods, we find that daily peak ozone amounts as well as average ozone concentrations substantially increase during summer in future climate conditions. This is mostly due to higher temperatures and reduced cloudiness and precipitation over Europe and it leads to a higher number of ozone events exceeding information and warning thresholds. Our results show a pronounced regional variability, with the largest effects of climate change on ozone concentrations occurring over England, Belgium, Germany and France. The temperature-driven increase in biogenic emissions appears to enhance the ozone production and isoprene was identified as the most important chemical factor in the ozone sensitivity. We also find that summer ozone levels in future climate projections are similar to those found during the exceptionally warm and dry European summer of 2003. Our simulations suggest that in future climate conditions summer ozone might pose a much more serious threat to human health, agriculture and natural ecosystems in Europe, so that the effects of climate trends on pollutant amounts should be considered in future emission control measures.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A2, SRES B2

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Meteorological Factors, Temperature

Air Pollution: Interaction with Temperature, Ozone

Temperature: Fluctuations

Geographic Feature: ☑

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Europe

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Mitigation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Long-Term (>50 years)